

We Claim:

1. A method for forming an array of a sample material on a surface of a substrate, comprising the steps of

providing a vesicle having an interior chamber containing a fluid,

disposing said vesicle adjacent a first location on said surface of the substrate,

controlling said vesicle to eject from said chamber a nanoliter volume of the fluid to dispense said fluid at said first location of said surface of the substrate, and

moving said vesicle to a set of positions adjacent said surface of the substrate, whereby fluid is dispensed at each location of said set for forming said array of sample material.

2. A method according to claim 1, including the further step of

providing a substrate having wells formed on said surface of the substrate for defining locations for receiving said fluid ejected from said chamber.

3. A method according to claim 1, including the further steps of

depositing a matrix material on a surface of said substrate.

4. A method according to claim 3, including the further step of

waiting a predetermined period of time to allow the solvent of said matrix material to evaporate.

5. A method according to claim 4 wherein said step of ejecting a nanoliter volume of fluid includes the step of ejecting said fluid onto said evaporated matrix material to dissolve with said matrix material and to form a crystalline structure on said substrate surface.

6. A method according to claim 1 including the step of

mixing an analyte material with a matrix material to form a solution, and

filling said interior chamber with said solution.

7. A method according to claim 1, including the further step of

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providing said substrate with said array of sample material disposed thereon to a diagnostic tool for determining information representative of the composition of said sample material.

8. A method according to claim 7, wherein said step of providing said substrate to a diagnostic tool includes the step of

providing said substrate to a diagnostic tool having a mass spectrometer.

9. A method according to claim 1, wherein said step of providing a vesicle having an interior chamber includes the step of providing a vesicle having a piezoelectric element for causing fluid to move through said chamber.

10. A method according to claim 9, wherein said step of moving said vesicle includes the step of rastering said vesicle across said surface of said substrate.

11. A method according to claim 1 wherein said step of providing a vesicle includes the step of providing a vesicle assembly having a plurality of vesicles arranged into a matrix for dispensing fluid to a first plurality of locations on said substrate surface.

12. A method according to claim 11 wherein said step of moving said vesicle array includes the step of determining an offset signal representative of a distance for moving said vesicle assembly to a location adjacent said first plurality of locations.

13. A method of according to claim 12 wherein said step of moving said vesicle assembly includes the step of moving said vesicle assembly over said surface of said substrate to form a matrix of locations having fluid ejected thereon.

14. A method according to claim 1, including the further step of
drawing a wash fluid into said chamber to rinse said chamber.

15. A method according to claim 1, including the further step of
contacting said vesicle to a source of fluid material for filling said chamber by capillary action.

16. A method according to claim 1, including the step of
providing a substrate material comprising silicon.

17. A method according to claim 1, including the step of
providing a substrate material comprising a metal material.

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18. A method according to claim 1, including the step of providing a substrate material comprising a plastic material.
19. A method according to claim 1, including the step of providing a substrate material comprising a membrane.
20. A method according to claim 1, including the step of providing a substrate material comprising a polymeric material.
21. A method according to claim 1, including the step of providing a substrate material comprising metal-grafted polymers.
22. A method according to claim 1, including the step of providing a chemically functionalized substrate material.
23. A method according to claim 1, including the step of providing a substrate material functionalized with beads.
24. A method according to claim 1, including the step of providing a substrate material functionalized with a dendritic material.
25. A method for analyzing a material, comprising the steps of providing a vesicle suitable for carrying a fluid having said material therein, disposing said vesicle adjacent a first location of a surface of a substrate, controlling said vesicle to deliver a nanoliter volume of the fluid to provide a defined and controlled volume of said fluid at said first location of said surface of the substrate, moving said vesicle to a second position adjacent a second location on said surface of the substrate to dispense a defined and controlled volume of said material along an array of locations on said substrate surface, and performing mass spectrometry analysis for said material at each location of said array.

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26. A method according to claim 25 wherein said step of providing a vesicle, includes the step of

mixing a matrix material and an analyte material to form said fluid material.

27. A method according to claim 25, including the steps of

providing a vesicle having an interior chamber suitable for holding a fluid, and

filling said chamber with a matrix material and dispensing said matrix material to said array of locations.

28. A method according to claim 25 wherein said step of performing mass spectrometry includes the step of performing matrix assisted laser desorption ionization mass spectrometry.

29. A method according to claim 25 wherein said step of performing mass spectrometry includes the step of performing a time of flight mass spectrometry analysis.

30. A method according to claim 25 wherein said step of performing mass spectrometry includes the step of performing a fourier transform mass spectrometry analysis.

31. Apparatus for forming an array of a sample material on a surface of a substrate, comprising

vesicle having a distal end suitable for carrying a fluid thereon,

a movable arm having a distal portion mounted to said vesicle,

a controller for moving said arm to dispose said vesicle adjacent a first location on said surface of the substrate and for controlling said vesicle to provide a nanoliter volume of the fluid at said first location of said surface of the substrate, and

a diagnostic tool for analyzing said material to generate a composition signal representative of the chemical composition of said material.

32. Apparatus according to claim 31 wherein said vesicle comprises a solid shaft of material.

33. Apparatus according to claim 31 wherein said vesicle comprises an interior chamber suitable for carrying a fluid material.

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34. Apparatus according to claim 31 wherein said vesicle comprises a chamber and a transducer element for ejecting fluid from said chamber.

35. Apparatus according to claim 31 wherein said diagnostic tool includes a mass spectrometer.

36. A substrate having a surface carrying an array of matrix material and formed according to a process comprising the steps of

providing a vesicle suitable for transferring a fluid containing a matrix material,

disposing said vesicle adjacent a first location on said surface of the substrate,

controlling said vesicle to deliver to a volume of the fluid to said first location of said surface of the substrate, and

moving said vesicle to a set of positions adjacent said surface of the substrate and delivering fluid at each location of said set to form an array of matrix material.

37. A substrate according to claim 36 having wells disposed on said surface.

38. A substrate according to claim 37 wherein said surface is pitted.

39. A substrate according to claim 37 wherein said wells have a rough interior surface.

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